AWB31D7 Data Sheet

1.2 GHz CATV Push-pull Amplifier MMIC

1. Product Overview

1.1 Features

- 5 ~ 1200 MHz Bandwidth
- 17.0 dB Gain at 500 MHz
- CSO : 68 dBc, CTB : 67 dBc
  @ Pout = 99 dBμV flat for NTSC 79 channels + QAM256 75 channels, -6 dB offset
- Robust under Hard Operating Conditions
- +5 V, 220 mA Supply

1.2 Applications

- CATV Line Amplifiers
- HFC Nodes
- Head End Equipment

1.3 Package Profile & RoHS Compliance

	RoHS-compliant GREEN Package
SOIC8, 6.0x4.8 mm^2, surface mount	RoHS-compliant

2. Summary on Product Performances

2.1 Typical Performance

Supply voltage = +5 V, T_A = +25 °C, Z_O = 75 Ω.

Parameter	Typical				Unit
Frequency	50	500	1002	1200	MHz
Gain	17.2	17.0	17.0	17.1	dB
S11	-20.0	-15.0	-18.0	-18.0	dB
S22	-20.0	-14.0	-18.0	-15.0	dB
Output IP3[1)]	39	42	41	37	dBm
Output IP2[1),2)]	81	62	65	50	dBm
Output P1dB	25	26	25	25	dBm
Noise Figure	2.4	2.2	2.1	2.2	dB
CSO[1)]	68				dBc
CTB[1)]	67				dBc
Current	220				mA
Device Voltage	+5				V

1) OIP3 and OIP2 are measured with two tones at an output power of +10 dBm/tone separated by 6 MHz.

2) OIP2 is measured at F1+F2 Frequency.

3) CSO & CTB measured at Pout = 99 dBμV flat for NTSC 79 channels + QAM 256 75 channels, -6 dB offset.

2.2 Product Specification

Supply voltage = +5 V, T_A = +25 °C, Z_O = 75 Ω.

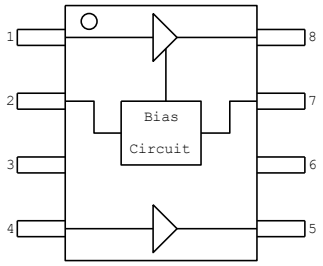
Parameter	Min	Typ	Max	Unit
Frequency		500		MHz
Gain		17.0		dB
S11		-15		dB
S22		-14		dB
Output IP3[1)]		42		dBm
Output IP2[1),2)]		62		dBm
Output P1dB		26		dBm
Noise Figure		2.2		dB
Current		220		mA
Device Voltage		+5		V

1) OIP3 and OIP2 are measured with two tones at an output power of +10 dBm/tone separated by 6 MHz.

2) OIP2 is measured at F1+F2 Frequency.

2.3 Pin Configuration

Pin	Description	Simplified Outline
1, 4	RF_IN	
2	Current Adjustable	
7	V_{CG} Adjustable	
5, 8	RF_ OUT	
3, 6	NC or GND	



Note: Backside metal paddle is RF and DC ground.

2.4 Absolute Maximum Ratings

Parameters	Max. Ratings
Operation Case Temperature	-40 to +85 °C
Storage Temperature	-40 to +150 °C
Device Voltage	+10 V
Maximum Current	450 mA
Operation Junction Temperature	+160 °C
Input RF Power (CW, 75 Ω matched)	+25 dBm

2.5 Thermal Resistance

Symbol	Description	Typ	Unit
R_{th}	Thermal resistance from junction to lead	17	°C/W

2.6 ESD Classification & Moisture Sensitivity Level

ESD Classification

HBM	Class 1B	Voltage Level: 750 V
MM	Class A	Voltage Level: 100 V

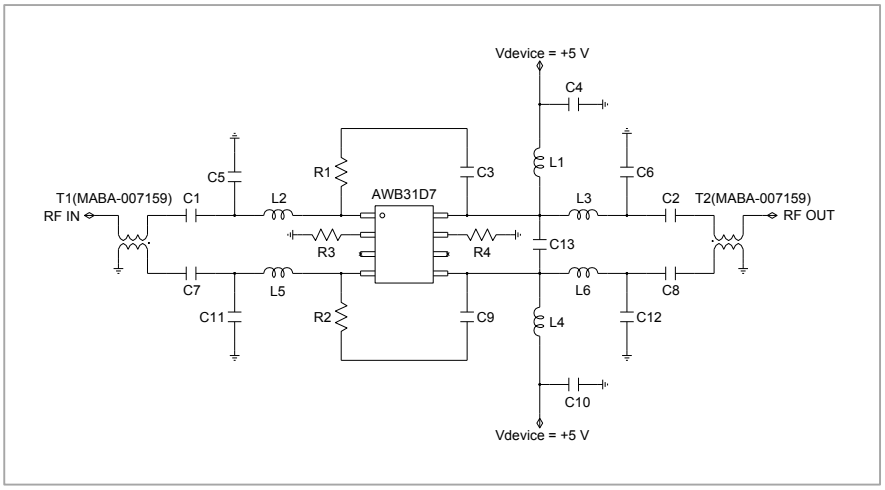
CAUTION: Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

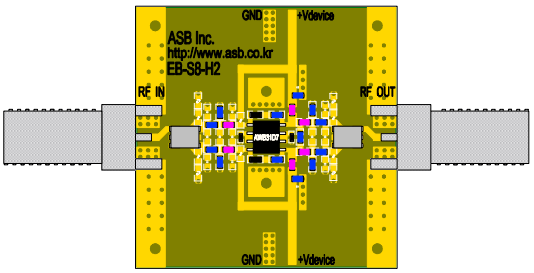
Moisture Sensitivity Level

MSL 3 at 260 °C reflow

3. Application: 50 ~ 1200 MHz (75 Ω Push-pull, V_{supply} = +5 V)

3.1 Application Circuit & Evaluation Board





PCB Information	
Material	FR4
Thickness (mm)	0.8
Size (mm)	40x40
EB No.	EB-S8-H2

Bill of Material

Symbol	Value	Size	Description	Manufacturer
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C1, C2, C7, C8	1 μF	0603	DC blocking capacitor	Murata
C3, C9	1 μF	0603	Feedback capacitor	Murata
C4, C10	10 μF	0805	Decoupling capacitor	Murata
C5, C11, C13	0.5 pF	0603	Matching capacitor	Murata
C6, C12	1.2 pF	0603	Matching capacitor	Murata
L1, L4	1 μH	1206	RF choke inductor	Murata
L2, L5	1.8 nH	0603	Matching inductor	Murata
L3, L6	2.7 nH	0603	Matching inductor	Murata
R1, R2	360 Ω	0603	Feedback resistor	Samsung
R3	39 Ω	0402	Current adjust resistor	Samsung
R4	1.1 kΩ	0402	V_{CG} adjust resistor	Samsung
T1, T2	1:1	-	Transformer balun	MACOM

3.2 Performance Table

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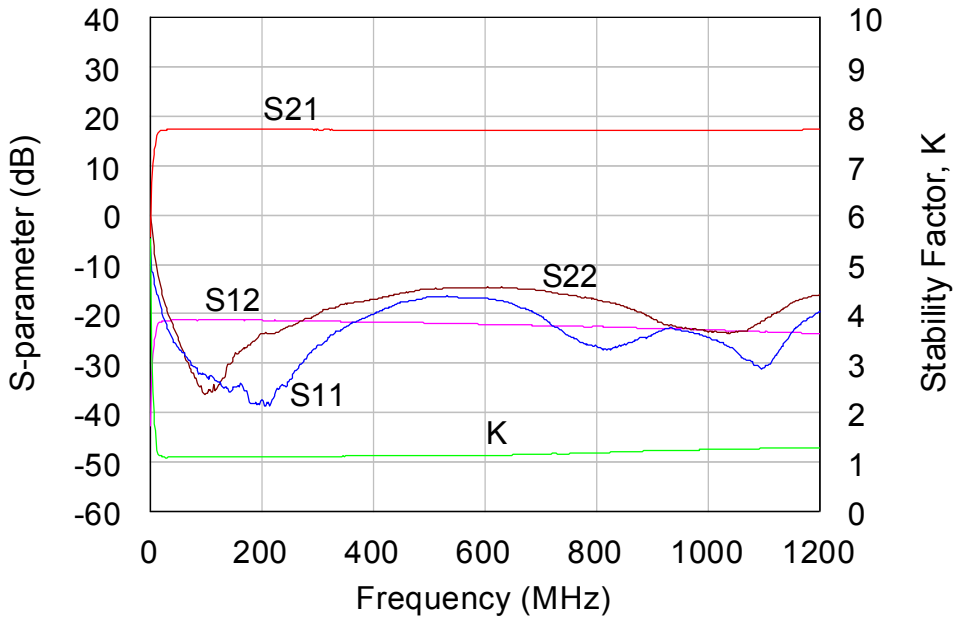
CSO[1)]	68				dBc
CTB[1)]	67				dBc
Current	220				mA
Device Voltage	+5				V

1) OIP3 and OIP2 are measured with two tones at an output power of +10 dBm/tone separated by 6 MHz.

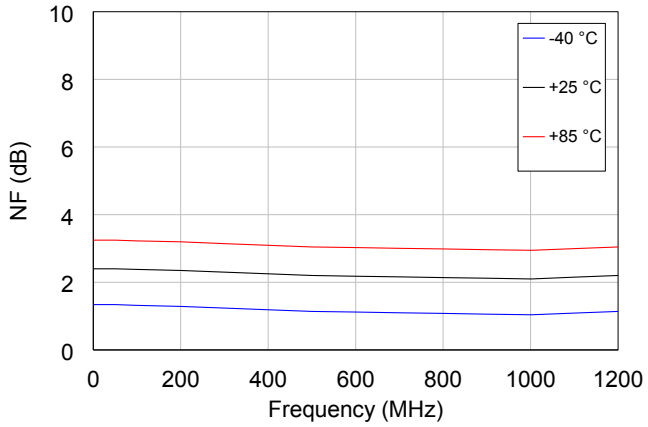
2) OIP2 is measured at F1+F2 Frequency.

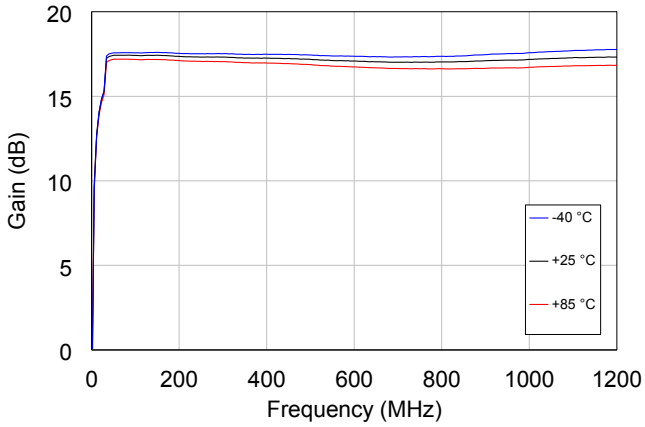
3) CSO & CTB measured at Pout = 99 dBμV flat for NTSC 79 channels + QAM 256 75 channels, -6 dB offset.

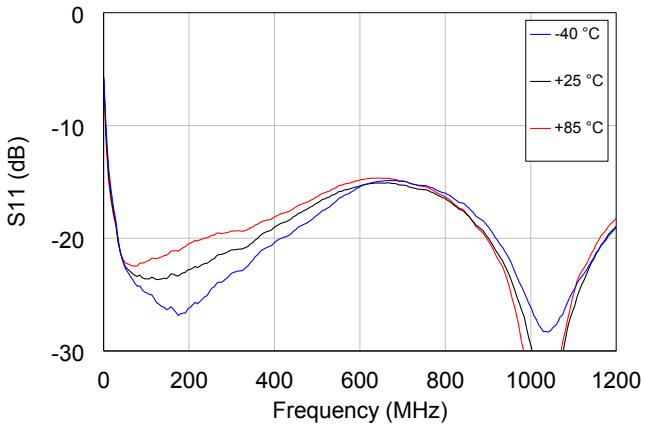
3.3 Plot of S-parameter & Stability Factor

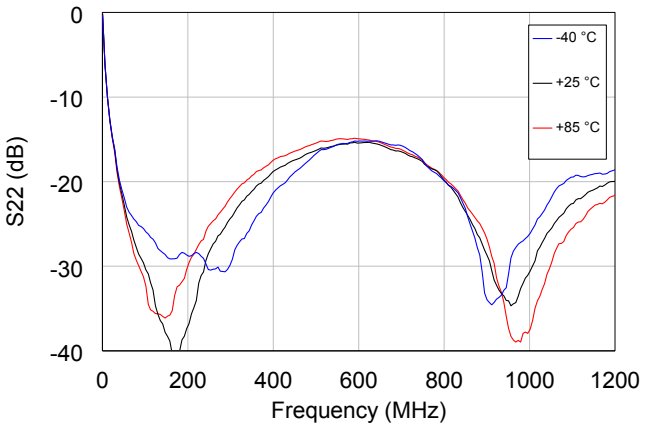


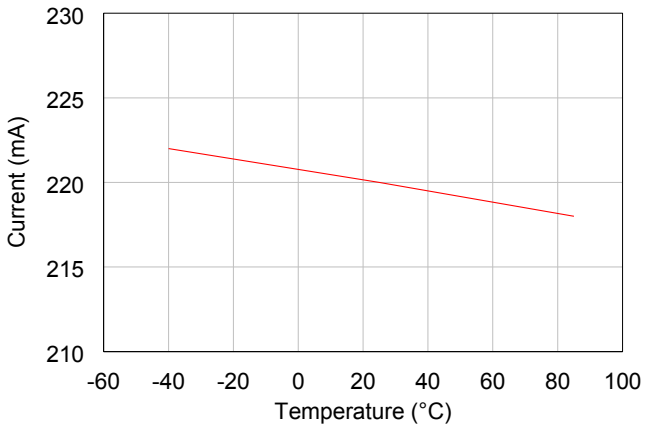
3.4 Plots of Noise Figure and Performances with Temperature

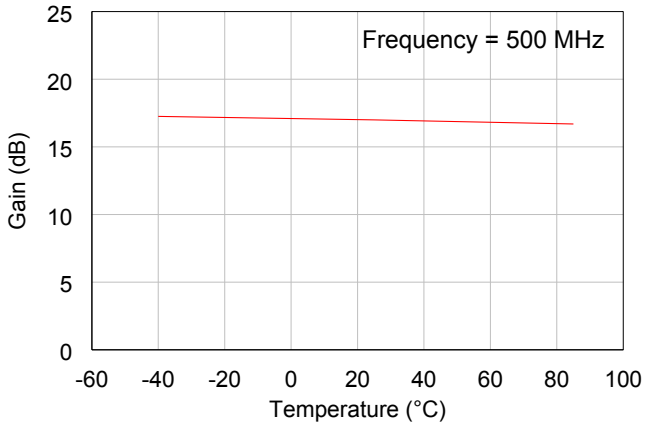


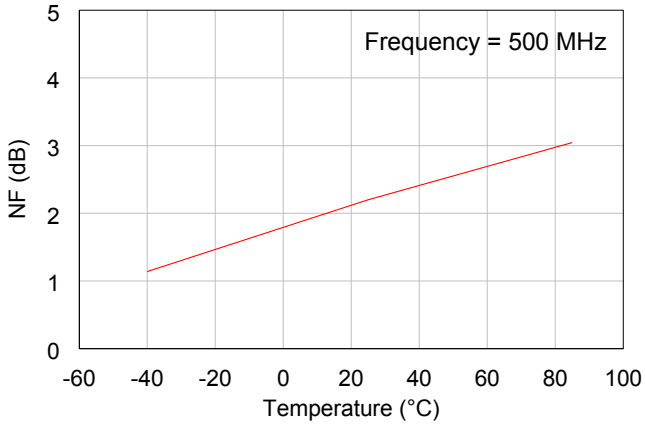


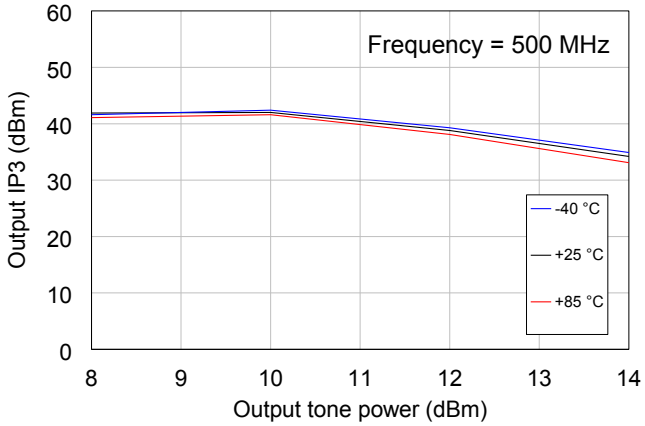


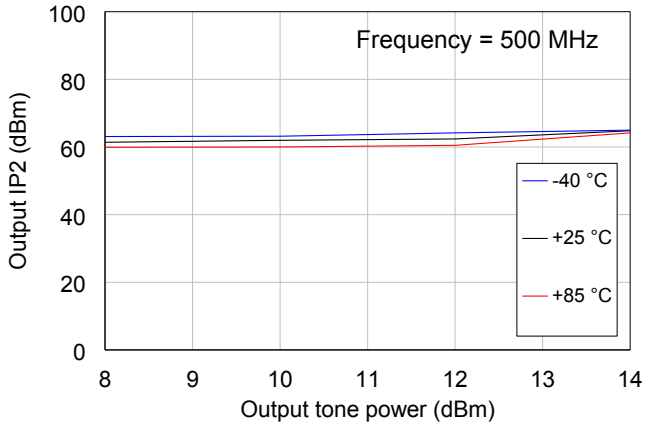












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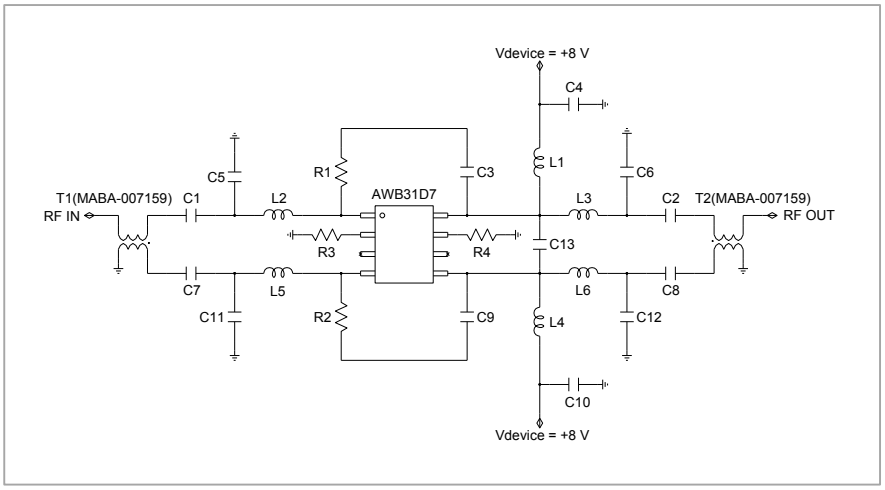
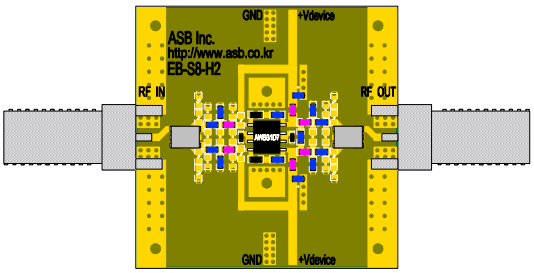
4. Application: 50 ~ 1200 MHz (75 Ω Push-pull, V_{supply} = +8 V)

4.1 Application Circuit & Evaluation Board





PCB Information	
Material	FR4
Thickness (mm)	0.8
Size (mm)	40x40
EB No.	EB-S8-H2

Bill of Material

Symbol	Value	Size	Description	Manufacturer
AWB31D7	-	-	MMIC Amplifier	ASB
C1, C2, C7, C8	1 μF	0603	DC blocking capacitor	Murata
C3, C9	1 μF	0603	Feedback capacitor	Murata
C4, C10	10 μF	0805	Decoupling capacitor	Murata
C5, C11, C13	0.5 pF	0603	Matching capacitor	Murata
C6, C12	1.2 pF	0603	Matching capacitor	Murata
L1, L4	1 μH	1206	RF choke inductor	Murata
L2, L5	1.8 nH	0603	Matching inductor	Murata
L3, L6	2.7 nH	0603	Matching inductor	Murata
R1, R2	360 Ω	0603	Feedback resistor	Samsung
R3	18 Ω	0402	Current adjust resistor	Samsung
R4	1.1 kΩ	0402	V_{CG} adjust resistor	Samsung
T1, T2	1:1	-	Transformer balun	MACOM

4.2 Performance Table

Supply voltage = +8 V, T_A = +25 °C, Z_O = 75 Ω.

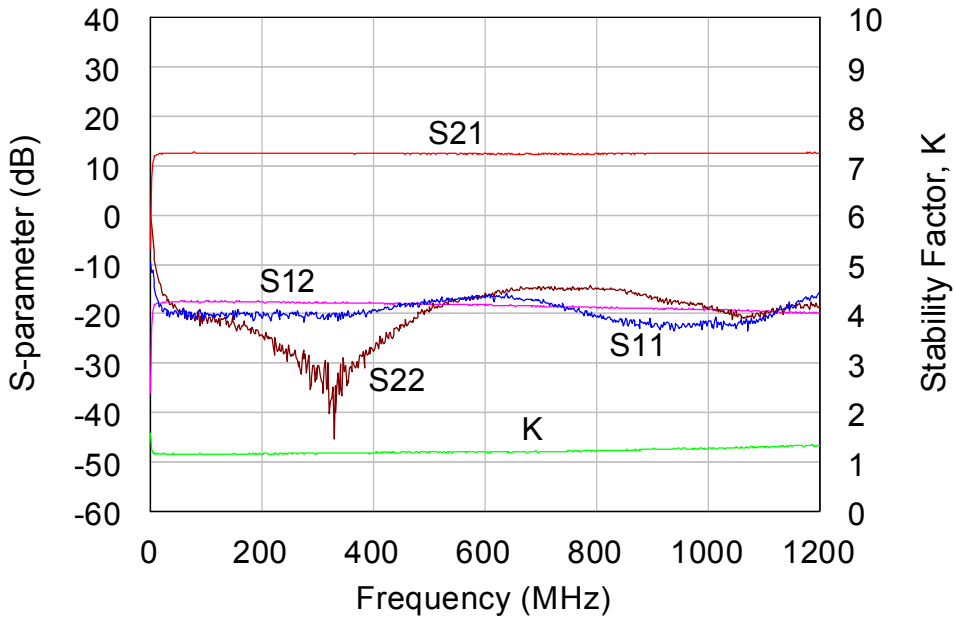
Parameter	Typical				Unit
Frequency	50	500	1002	1200	MHz
Gain	17.3	17.1	17.1	17.2	dB
S11	-22.0	-16.0	-22.0	-17.0	dB
S22	-20.0	-14.0	-17.0	-15.0	dB
Output IP3[1)]	40	43	42	38	dBm
Output IP2[1),2)]	81	62	65	50	dBm
Output P1dB	25	26	25	25	dBm
Noise Figure	2.8	2.4	2.3	2.4	dB
CSO[1)]	71				dBc
CTB[1)]	63				dBc
Current	340				mA
Device Voltage	+8				V

1) OIP3 and OIP2 are measured with two tones at an output power of +10 dBm/tone separated by 6 MHz.

2) OIP2 is measured at F1+F2 Frequency.

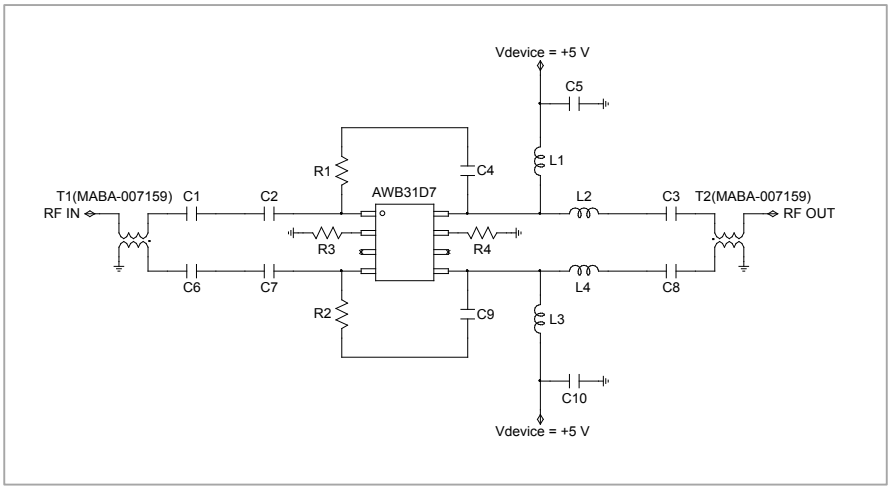
3) CSO & CTB measured at Pout = 103 dBμV flat for NTSC 79 channels + QAM 256 75 channels, -6 dB offset.

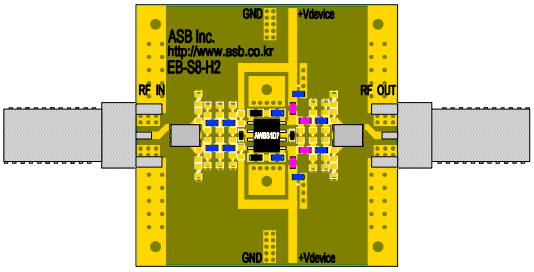
4.3 Plot of S-parameter & Stability Factor



5. Application: 5 ~ 300 MHz (75 Ω Push-pull, V_{supply} = +5 V)

5.1 Application Circuit & Evaluation Board





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R1, R2	360 Ω	0603	Feedback resistor	Samsung
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5.2 Performance Table

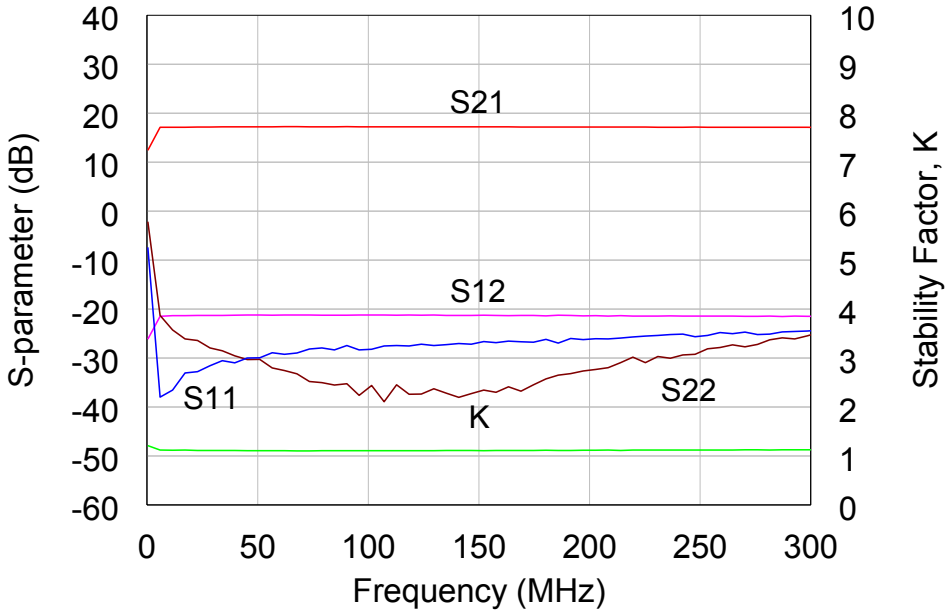
Supply voltage = +5 V, T_A = +25 °C, Z_O = 75 Ω.

Parameter	Typical			Unit
Frequency	5	50	300	MHz
Gain	17	17.2	17.1	dB
S11	-20	-20	-19	dB
S22	-18	-20	-19	dB
Output IP3[1)]	38	39	40	dBm
Output IP2[1),2)]	71	80	72	dBm
Output P1dB	25	25	26	dBm
Noise Figure		2.2	2.2	dB
Current	220			mA
Device Voltage	5			V

1) OIP3 and OIP2 are measured with two tones at an output power of +12 dBm/tone separated by 6 MHz.

2) OIP2 is measured at F1+F2 Frequency.

5.3 Plot of S-parameter & Stability Factor



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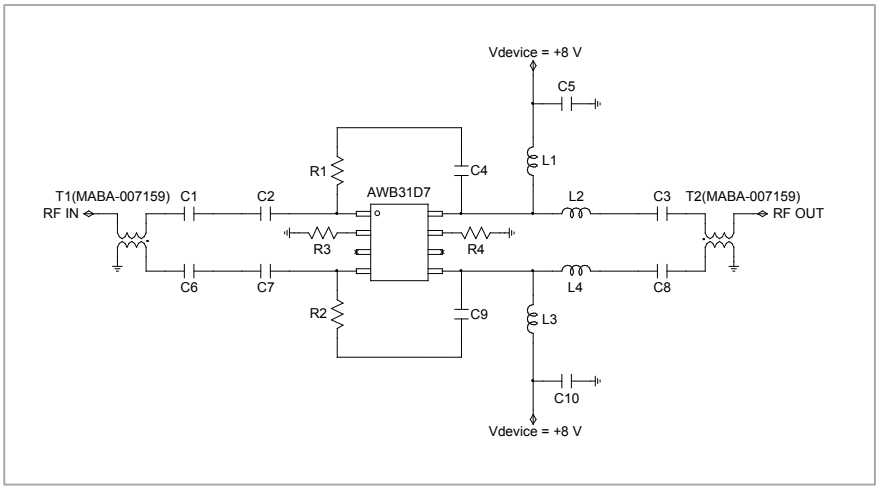
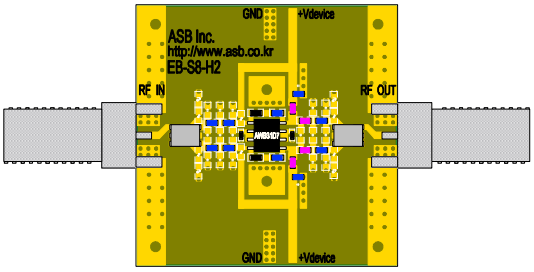
6. Application: 5 ~ 300 MHz (75 Ω Push-pull, V_{supply} = +8 V)

6.1 Application Circuit & Evaluation Board





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S11	-20	-20	-19	dB
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Output IP2[1),2)]	80	80	70	dBm
Output P1dB	28	28	29	dBm
Noise Figure		2.7	2.5	dB
Current	340			mA
Device Voltage	8			V

1) OIP3 and OIP2 are measured with two tones at an output power of +12 dBm/tone separated by 6 MHz.

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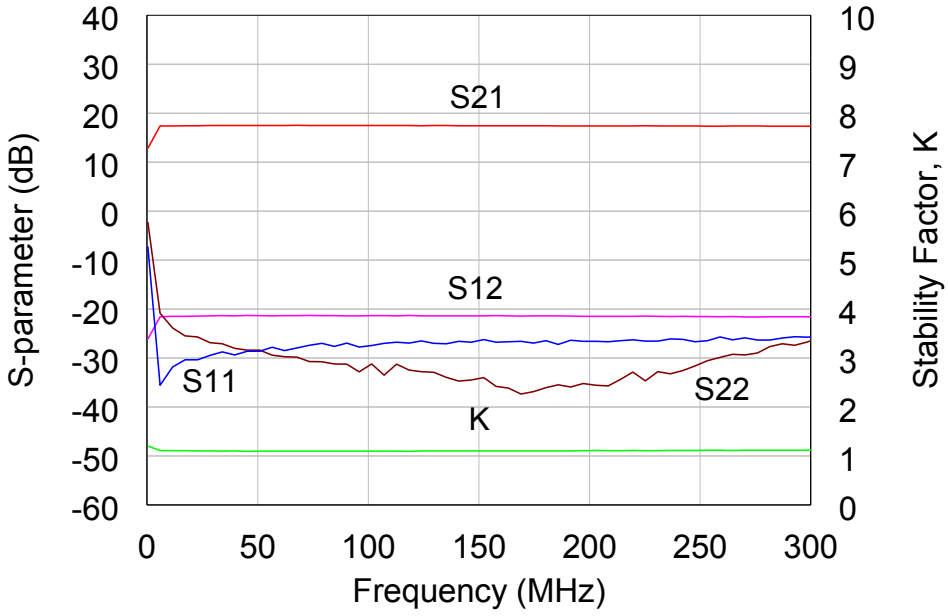
6.3 Plot of S-parameter & Stability Factor



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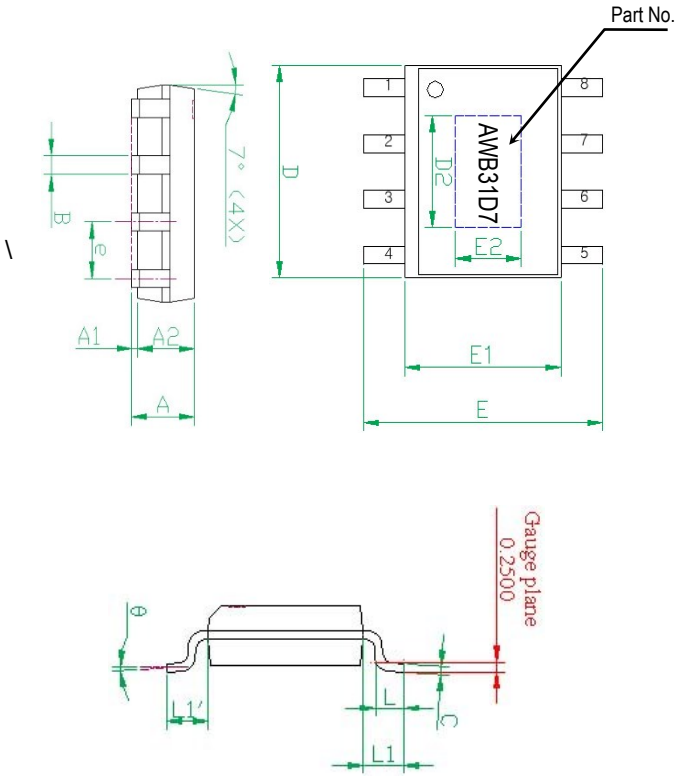
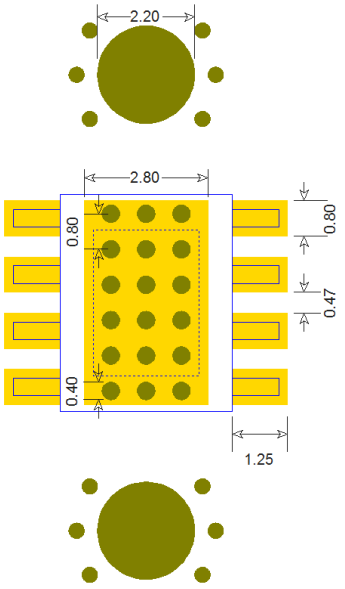
7. Package Outline (SOIC8)



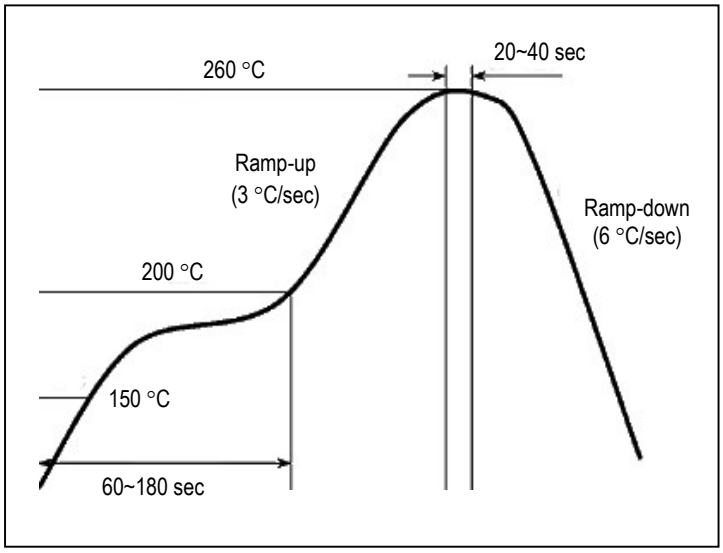
Symbols	Dimensions (In mm)		
	MIN	NOM	MAX
A	1.40	1.50	1.60
A1	0.00	---	0.10
A2	---	1.45	---
B	0.33	---	0.51
C	0.19	---	0.25
D	4.80	---	5.00
D2	3.20	3.30	3.40
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
E2	2.30	2.40	2.50
e	---	1.27	---
L	0.40	---	1.27
y	---	---	0.10
θ	0°	---	8°
|L1-L1'|	---	---	0.12
L1		1.04REF	

8. Surface Mount Recommendation (In mm)



NOTE
1. Add as much copper as possible to inner and outer layers near the part to ensure optimal thermal performance.
2. To ensure reliable operation, device ground paddle-to-ground pad soldering is critical.
3. Add mounting screws near the part to fasten the board to a heat sinker. Ensure that the ground & thermal via region contacts the heat sinker.
4. A proper heat dissipation path underneath the area of the PCB for the mounted device is strictly required for proper thermal operation. Damage to the device can result from inappropriate heat dissipation.

9. Recommended Soldering Reflow Profile



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